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Soil water retention dynamics in Luvisols at contrasting slope positions in lysimeter monoliths from an eroded soil landscape

Marcus Herbrich (1), Horst H. Gerke (1), Michael Sommer (1,2)

(1) Leibniz-Centre for Agricultural Landscape Research (ZALF), Institute of Soil Landscape Research, Müncheberg, Germany (Marcus.Herbrich@zalf.de), (2) Institute of Earth and Environmental Science, University of Potsdam (UP), Potsdam, Germany

Modeling water flow and solute transport in variably saturated soils requires the proper description of the soil water retention curve. The problem is that under field conditions, water retention may be hysteretic or otherwise changing in time due to changing soil properties. In arable soil landscapes, these changes may depend on the erosion history which created spatial patterns of soil properties such as texture and organic matter content and differences in crop development. The objective of this study was to analyze the dynamics in field-measured water retention data for Luvisols in 10 cm, 30 cm and 50 cm soil depth (Ap, E, and Bt horizons) at two contrasting at slope positions characterized by different degrees of soil erosion under intensive agricultural cultivation. Drying and wetting water retention was obtained from tensiometer/MPS and TDR data in depths representing same soil horizons. For comparison, we used drying retention data obtained from soil cores using the evaporation method (Hyprop). Drying data were fitted to the unconstrained water retention function proposed by van Genuchten (1980) and the bimodal model of Durner (1994). For wetting data, hydraulic model parameters were determined by using the Pedroso-Williams model (2010). The water contents of wetting and drying branches were dynamically changing. These changes in water retention were different for several horizons of the more eroded Luvisol as compared to the less eroded one. Differences in water retention dynamics could be related to soil tillage and the erosion history at the different slope positions. The water differences in retention could be explained by hysteresis and temporal changes in soil water repellency. Field and lab retention data differed as reported earlier. The results suggest that estimation of soil water retention curves without resorting to time-consuming field measurements remains challenging. The results suggest that for erosion-affected arable soils of the hummocky landscape, the soil water retention dynamics is spatially distributed and depending on the erosion gradient.